

(15,000 cfs operation), and 26 May-15 June (20,000 cfs operation). For the remainder of the fish flow days, releases were maintained to ensure that sufficient storage would be available for the entire flow period. Elevations at Kerr ranged from 301.6 to 306.7 feet during the period 1 April to 15 June. After the high flows in early April, an effort was made beginning on 20 April to release target-level flows thereafter, but additional rains in the first part of May made it necessary to go to upper-band releases which generally lasted through 11 May.

Hourly and Mean Flows

Charles S. Manooch, III and Marsha E. Shepherd

Roanoke River water flows were high during the spring of 1990 (Figure 50; Tables 38 and 39). Mean water flow for the period 1 March - 30 June was 12,909 cfs (Table 38) and was 14,283 cfs for the Negotiated Period, 1 April - 15 June (Table 39). By comparison, the mean flow for the Negotiated Period during the spring of 1988 was 5,669 cfs and was 13,712 cfs for 1989 (Rulifson and Manooch 1990a). Overall, only 20 days (26%) had mean daily flows that were within the upper and lower flow boundaries recommended by the Committee for the Negotiation Period (Table 36). This compares with 53 days (70%) for 1988 and 33 days (43%) during 1989 (Rulifson and Manooch 1990a; Table 31).

In terms of hourly data, only 23.5% of the hourly flows from 1 March - June 30 1990 were within the historical Q_1 - Q_3 flow boundaries identified by the Committee, whereas 31.8% of hourly flows were within the Negotiated Period flow boundaries. Approximately 62% of the hourly flows exceeded the upper flow boundary for the entire period and 68% exceeded the upper boundary for the Negotiated Period (Tables 38 and 39). During the Negotiated Period, 57% of the days (43) had every hourly flow exceeding the recommended upper boundary (i.e., Q_3).

The Committee has recommended that water flows not change more than 1,500 cfs during any hour from 1 April - 15 June each year (Manooch and Rulifson 1989). Flow stability was evident in 1990 (Figure 51; Table 40) as it was during 1989 (see Table 7 in Rulifson and Manooch 1990a) as approximately 99% of the hourly variation was less than 1,500 cfs for both years.

The trend in water flow during the spring of 1990 was atypical of historical trends. Historically, flows have been relatively high during March and early April and then decrease during late April, May, and June. In 1990 flows were high during March and early April, decreased somewhat during late April and early May, but then increased during late May and June. This is a reversal of the preimpoundment (natural) trend.

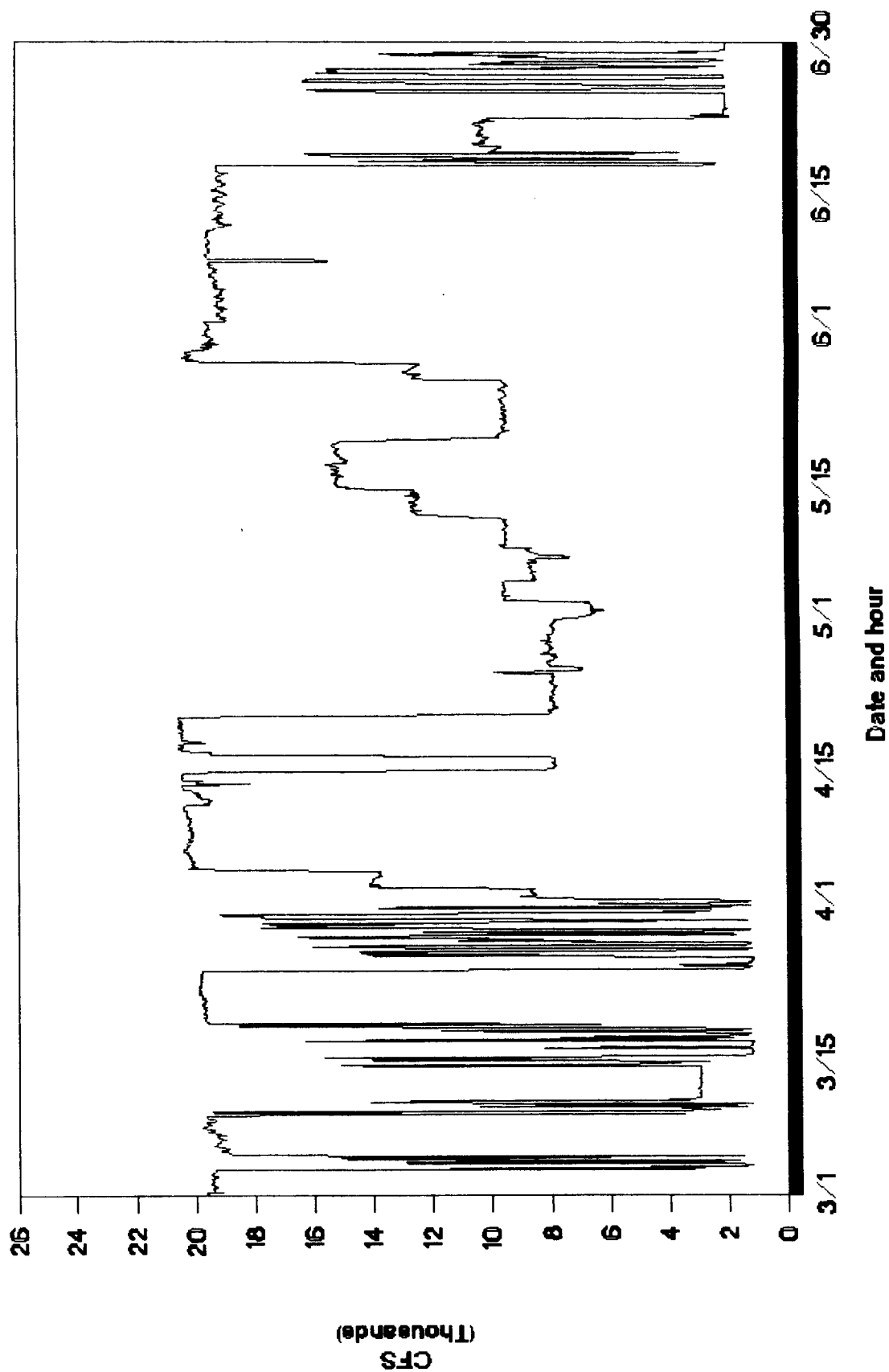


Figure 50. Hourly record of Roanoke River flows (cfs) downstream of the Roanoke Rapids Reservoir (USGS data), March through June 1990).

Table 38. Weekly summaries for 1990 hourly flows using Table 14 Q_1 - Q_3 boundaries.

Week	Dates	Total # Hours	# Hours < Q_1	% Hours < Q_1	# Hours (Q_1 - Q_3)	% Hours (Q_1 - Q_3)	# Hours > Q_3	% Hours > Q_3	Mean Flow CFS	Std Flow CFS	Mean Abs Hr DIFF
1	01 Mar-07 Mar	168	20	11.9	7	4.2	141	83.9	16,531	5,671	687
2	08 Mar-14 Mar	168	110	65.5	15	8.9	43	25.6	7,992	7,215	726
3	15 Mar-21 Mar	168	73	43.4	20	11.9	75	44.6	10,919	8,214	995
4	22 Mar-28 Mar	168	60	35.7	28	16.7	80	47.6	11,618	7,917	923
5	29 Mar-04 Apr	168	45	26.8	83	49.4	40	23.8	10,746	5,791	866
6	05 Apr-11 Apr	168	.	.	.	.	168	100.0	20,166	190	27
7	12 Apr-25 Apr	168	.	.	37	22.0	131	78.0	17,408	4,971	205
8	19 Apr-25 Apr	168	.	.	122	72.6	46	27.4	11,177	5,465	130
9	26 Apr-02 May	168	.	.	166	98.8	2	1.2	7,637	636	60
10	03 May-9 May	168	.	.	85	50.6	83	49.4	8,988	570	51
11	10 May-16 May	168	.	.	25	14.9	143	85.1	12,629	2,137	71
12	17 May-23 May	168	.	.	89	53.0	79	47.0	11,966	2,752	66
13	24 May-30 May	168	.	.	.	.	168	100.0	14,427	4,517	119
14	31 May-06 Jun	168	.	.	.	.	168	100.0	19,251	213	42
15	07 Jun-20 Jun	168	.	.	.	.	168	100.0	19,175	761	78
16	14 Jun-20 Jun	168	9	5.4	4	2.4	155	92.3	14,957	5,234	464
17	21 Jun-27 Jun	168	83	49.4	3	1.8	82	48.8	6,812	5,101	508
18	28 Jun-30 Jun	72	34	47.2	4	5.6	34	47.2	6,042	4,261	906
19	=====										
20	01 Mar-30 Jun	2,928	434	14.8	688	23.5	1806	61.7	12,909	6,367	367

Table 39. Weekly summaries for 1990 hourly flows using Table 17 median Q_1 - Q_3 boundaries.

Week	Dates	Total # Hours	# Hours < Q_1	% Hours < Q_1	# Hours (Q_1 - Q_3)	% Hours (Q_1 - Q_3)	# Hours > Q_3	% Hours > Q_3	Mean Flow CFS	Std Flow CFS	Mean Abs Hr DIFF
1	01 Apr-07 Apr	360	9	2.5	55	15.3	296	82.2	17,150	4,967	135
2	16 Apr-30 Apr	360	.	.	255	70.8	105	29.2	11,424	5,534	115
3	01 May-15 May	360	.	.	205	56.9	155	43.1	9,985	2,361	70
4	16 May-31 May	384	.	.	66	17.2	318	82.8	13,721	4,007	86
5	01 Jun-15 Jun	360	.	.	.	.	360	100.0	19,175	535	60
6	=====	.	.	.	.	.	.	.	.	.	.
7	01 Apr-15 Jun	1,824	9	0.5	581	38.1	1,234	67.6	14,283	5,205	93

Table 40. Weekly summaries of Roanoke River flow in 1990 based on absolute value of hourly variation; based on Negotiated Flow Regime.

Week	Dates	Total # hours	# hours <=1,500	% hours <=1,500	# hours >1,500	% hours >1,500
1	01 Apr-15 Apr	360	350	97.2	10	2.8
2	16 Apr-30 Apr	360	353	98.1	7	1.9
3	01 May-15 May	360	360	100.0	0	0.0
4	16 May-31 May	384	383	99.7	1	0.3
5	01 Jun-15 Jun	360	358	99.4	2	0.6
6	=====	.	.	.	.	.
7	01 Apr-15 Jun	1,824	1,804	98.9	20	1.1

Table 17 = Negotiated values: used here for 1 April - 15 June.

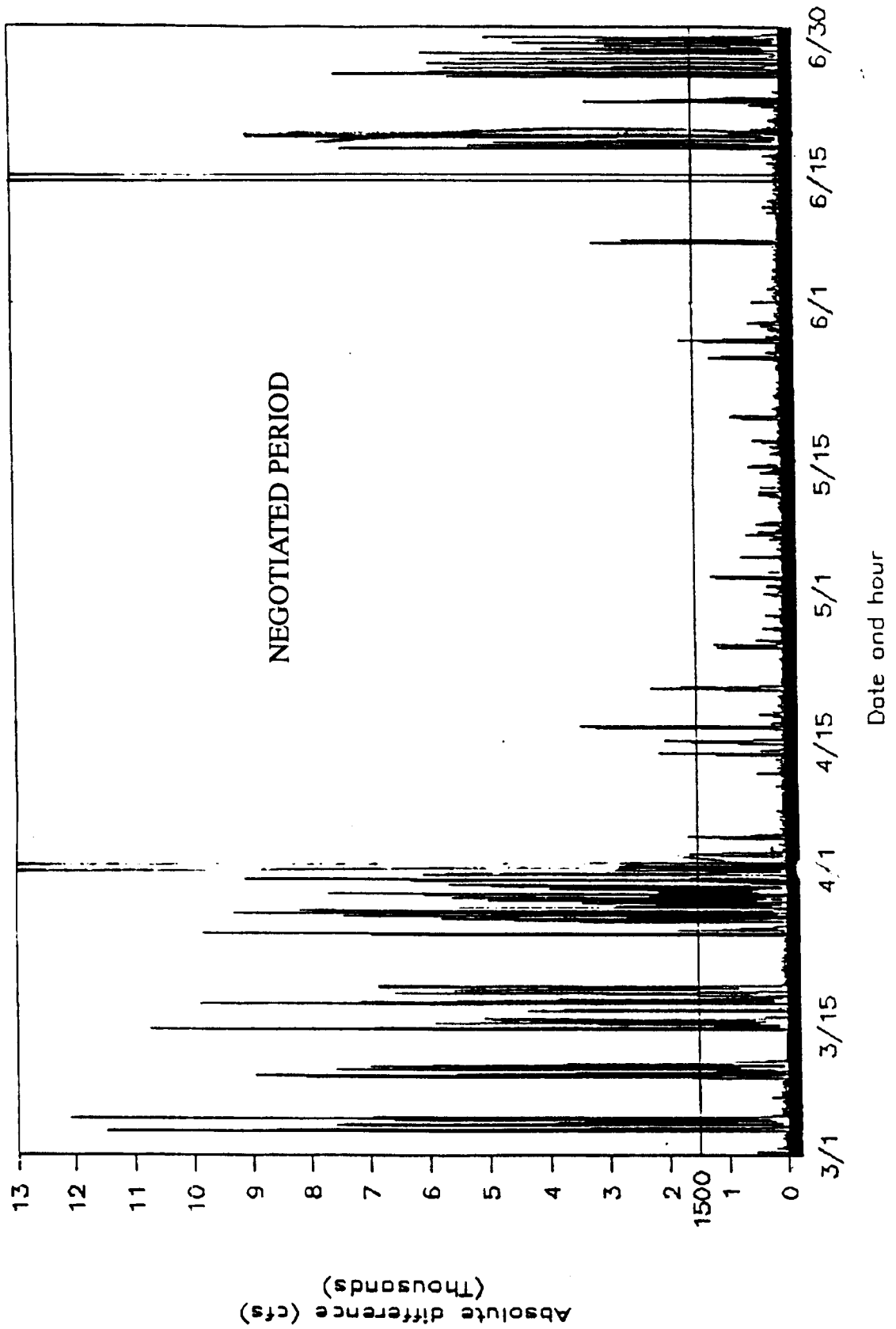


Figure 51. Roanoke River hourly difference for Negotiated Period.